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## The effect of problem-based learning on students' learning attitude in tertiary level education: A case study of the college system in Bangladesh

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### Abstract

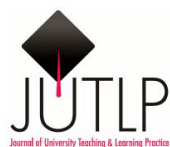
This study was initiated to explore the effect of problem-based learning on learners' attitudes among tertiary level students. The decision to concentrate on a sample from Bangladesh was motivated largely by that country's poor record to date in pedagogical innovation, meaning that the experiment could take place in the closest thing to an uncontaminated laboratory as this type of research permits. That students' attitudes towards learning were positively influenced by PBL to a statistically significant degree can be taken as a decisive endorsement of the method as a vehicle for teaching and learning. Clearly, the students who made up the sample have an appetite for constructivist approaches that place them at the center and redefine the teacher as a facilitator, rather than an orator. As a contribution to the debate about future educational directions in Bangladesh, this is highly persuasive.

### Practitioner Notes

1. Traditional methods do not tend to engender a positive attitude in students and so are to be either avoided or, at least, used judiciously. At most, they should be part of a mix that includes more student-centred approaches, such as problem-based learning. 2. Students respond best to constructivist approaches that build on current knowledge. The best PBL projects are those that draw on material to which they can easily relate, so lesson planning should be based around real world issues that, as far as possible, touch on areas of personal interest for the students. 3. Teachers should reconceptualise themselves as facilitators of learning, their role being to guide students towards meaningful solutions, rather than as experts committed to only one outcome. The teacher, then, should set the problem, advise on methodology and monitor progress, but without dictating a direction. 4. PBL projects should be planned to allow for genuine problem-solving in a collaborative environment. Students should be given opportunities to claim ownership of their work. 5. Assessment should take into account the process as much as the outcome and there should not, ideally, be only a single outcome: the purpose of problem-solving should be to give students the chance to undergo a process of discovery.

### Keywords

Problem-based learning, student learning attitude



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### **Abstract**

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## Introduction

Students in the twenty first century are preparing themselves for a highly unpredictable future: it has been estimated that some 85 percent of jobs that will be on offer in 2030 are yet to be invented or properly defined (Smart Industry, 2018). Employees of the future will not only have to master new skills, but whole new ways of thinking: adaptability, a group work mentality and problem-solving abilities will be critical parts of any job applicant's toolbox. It follows, then, that any teaching and learning approach based on pure memorisation will be out-of-date; capacity building for creativity, active listening, self-learning that connects education to reality, teamwork, empathy and analytical capability will all be required (Rokonuzzaman, 2019). Universities across the globe, including those in Bangladesh, face pressing issues around the creation of relevant syllabuses, modules, lectures, and practical sessions that prepare students for employment. The demand for graduates with the strongest employability skills has risen significantly despite the recent surge in global unemployment brought on by the COVID-19 pandemic. That Bangladesh is falling through the gap was indicated by a recent Daily Star finding that 37 percent of Bangladeshi's male graduates and 43% of the female graduates are registered as unemployed: the ongoing pandemic could drastically increase these numbers (Islam & Mohamad Saif, 2020). So, the question now is, how relevant are current teaching and learning strategies in preparing students for future employment? The answer will bear on both the global and specifically Bangladeshi contexts.

Moving forward, Bangladesh needs to shift its educational paradigm. A majority of the teachers involved in higher education are practising traditional teaching and learning methods (Al-Faruki et al., 2019). It is also noticeable that students in Bangladesh's higher education system display a lack of interest in learning, the general adherence to rote teaching and learning strategies being culpable (Hossain & Khan, 2015). As a consequence, levels of student absenteeism are high and students are not gaining the skills demanded by employers. Negative student attitudes towards teaching and learning are the inevitable upshot. For the educational paradigm shift to happen to address the current need for graduate employability, the study discussed in this article was initiated. It aims to identify the effectiveness of problem-based learning (PBL) on enhancing student attitudes towards learning.

PBL is an instructional solution to some of the learning problems touched on above (Hung et al., 2008). The key aim of PBL is to encourage learners to solve problems by acquiring new knowledge and adapting it to existing knowledge. Arguably, it is an educational strategy that can be a great asset in these uncertain times – one that could enhance students' learning skills and develop their attitude toward teaching and learning. According to Hossain and Sultana (2019) students, through PBL, are able to develop their skills through direct engagement with effective problem-solving techniques of direct relevance to real life situations. As Mohd Yusof et al. (2011) contend, PBL is a strategy that privileges learners in the educational process. If, for example, a small group of learners help each other to solve an assigned problem, basing their participation on past knowledge, they can use reflective discussion to reach novel conclusions. As this suggests, PBL is not the way of memorisation (Ribeiro, 2011), but the construction of new knowledge. Hmelo-Silver (2004) found that the aims of PBL instruction are not only to enhance the learning skills and knowledge of the students, but also to develop their critical thinking, and to enhance their motivation. Such innovative processes of learning becoming an alternative to traditional rote teaching has been accelerated by the COVID-19 pandemic. Colao et al. (2020) stated that the crisis gives teachers and students the opportunity to re-assess the methods of instruction that will have a role to play in the months and years to come. They further added that a wide range of participatory activities like small working groups in a real-life situation could be used within the pandemic's constraints.

PBL continues to significantly impact teaching and learning processes. Many studies have examined the impact of PBL on student learning (Albanese & Mitchell, 1993; Hmelo-Silver

2004; Yadav et al., 2011; Yew & Goh, 2016), academic performance (Jiménez-Mejías et al., 2015; Sleight & Mavis, 2006), and students' attitude to learning (Awan et al., 2017; Demiral & Dagyar, 2016; Ferreira & Trudel, 2012; Fidan & Tuncel, 2019; Lea et al., 2003, Selccedil, 2010). For instance, Lea et al. (2003) identify that learners have positive attitudes towards active learning approaches such as PBL. The effectiveness of the method depends on how students understand the learning scope, standard of the lessons, state of knowledge application, and mutual interaction. In the context of Bangladeshi higher education, teaching and learning activities related to PBL are almost non-existent. This is mainly because teachers prefer to use traditional teaching and learning techniques that are focused only on preparation for summative examinations (students are able to sit for the final exam even if their class attendance is low). They also have to work with large classes, a general lack of resources, and many other factors. These clearly show that students' learning attitude is determined by largely negative educational experiences; a positive attitude springs from experiences being at least acceptable (and having a positive impact on the students) and vice versa (Rahman, 2019).

In a study conducted by Hossain and Sultana (2019) it was shown that, in a PBL session, participants demonstrated a positive attitude towards group work and group presentation. In the context of this study, 'student learning attitude' refers to the attitude of the students towards learning scope, standard of the lessons, state of knowledge application for problem solving, and mutual interaction. Sugeng and Suryani (2020) also agreed that these components are crucial in PBL which promotes students' real world problem solving skills. Hence, in today's dynamic environment, the learners' positive attitude toward real world problem solving capacity is crucial. A note of caution would be that Hossain and Sultana's study (2019) concentrated on the primary level and its findings might not be generalizable to Bangladeshi higher education. Given this, the present researchers took the opportunity to fill the resulting gap in the literature by examining the effect of PBL on the attitudes of undergraduates studying at a college in Bangladesh.

## **Literature**

### ***Problem-based learning (PBL)***

As has been seen, PBL is an instructional student-centred approach that allows students to conduct research and incorporate theory into practice. It involves knowledge application, and skills development to solve real life problems (Savery, 2015). Similarly, Hmelo-Silver (2004) describes PBL as an instructional method in which students learn through facilitated, but self-regulated, group problem solving that centres on complex material. It calls for new knowledge to be added to an extant store and developed through reflection.

From a theoretical perspective, PBL is grounded in the constructivist teaching and learning approach (Russel et al., 1994; Savery & Duffy, 1995; Schmidt, 1995). According to this, learners make sense of new information based on prior knowledge and the learning experience or environment (Arends, 1998; Elliott et al., 2000). Tam (2000) argues that teaching and learning based on constructivist principles allows knowledge and authority sharing between teachers and students, with the teacher acting as a facilitator or guide, and learning occurring in a small heterogeneous group. Similarly courses based on PBL include realistic problems, tutor facilitation that supports reflection and group work, and independent thought (Hendry et al., 1999). PBL also obliges learners to be involved actively in the process of discovering, retrieving, and using new information, either by relating it to prior knowledge, or by constructing new knowledge (Schmidt, 1995; Sugeng & Suryani, 2020). All these elements provide a necessary context for students to develop competencies that will be helpful for their future employability and life-long learning.

The PBL approach introduced by Howard Barrows in 1960's for medical education, refers to an effective teaching-learning method that can enhance learners' transferable competencies such as problem-solving skills, critical-thinking skills, and group work capability (Kivela & Kivela, 2005). That it was successful in these aims can be demonstrated by its rapid adoption by medical schools and, shortly afterwards, more diverse schools and colleges. (Savery, 2015). That said, there is no single way to conduct PBL - there are many variations and some are assimilated with other approaches. Nonetheless, Boud and Felati (1997) suggested some common characteristics: 1) stimulus materials presenting real life problem, 2) teacher to facilitate the students to think critically to solve the given problem, 3) students to work in a group to explore information inside and outside the class, 4) students to identify their own learning needs and resources, and 5) students to reapply new knowledge to the given problem and evaluate their learning process. This systematic approach has been proven to provide a platform for students to enhance their employability through active and deep learning (Figure 1).

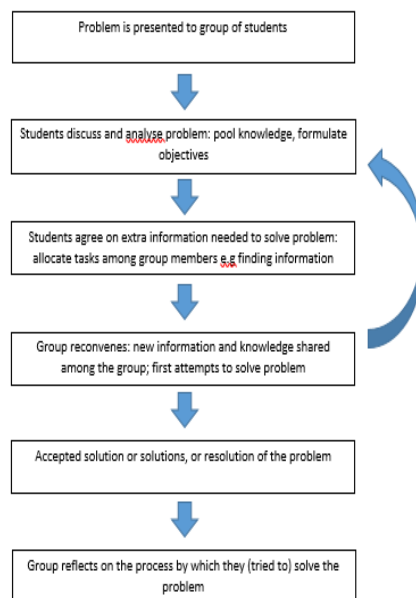
Against this can be placed the Bangladeshi higher education system, which is heavily teacher-centred (instructor-oriented strategy). Learners are therefore passive, absorb knowledge at the surface level, of memorization only (Biggs, 1999; Catalano & Catalano, 2013; Entwistle, 2013; Ramsden, 1992). In that the major concern of students is to pass their final examinations, the overall system is almost entirely led by evaluation of learning, dominated by the national examination system (Das et al., 2014; Rahman, 2015). A student's priority is the end result, not the process of teaching and learning, which is a contributor to the high level of student absenteeism. Students are able to pass the examination regardless of their class attendance rate, as they can memorize from books, modules, and past examination papers. The situation is exacerbated by rote teaching and learning, a lack of interest in the subject matter, an unfavourable teaching environment, and other factors (Chong et al., 2009; Cleary-Holdforth, 2007; Wadesango & Machingambi, 2011). It should not be surprising that, in such an environment, students' learning attitude is poor. There is little room in the current structure for students and teachers to immerse themselves in engaging problems (Savery, 2015). For an educational paradigm shift to happen in Bangladesh, teaching and learning approaches need to build students' competencies for graduate employability through the promotion of real world problem solving skills. In order to fully integrate PBL into the existing curriculum, it is crucial for researchers to understand student learning attitudes towards it.

### ***Learning attitude and PBL***

'The primary responsibility of higher education is to assist students in their development of the capability to benefit from and cope with modern life' (Engel, 1997, p.17). In order for students to benefit from and cope with modern life including work, students must have more than just a store of knowledge: they need competencies such as communication skills, reasoning, critical thinking, problem solving skills, an ability to work with others, amongst others. In addition, teaching and learning processes should cover the cognitive, affective, and psychomotor domains to shape a student as a whole being as indicated by Bloom et al. (1956). However, in many education systems (including that of Bangladesh), the affective domain is neglected in comparison to the cognitive and psychomotor domains (Shephard, 2008). For the purposes of this study, the researchers focused on the affective (attitude) domain. The affective domain is about value, attitude, and behaviour. For instance, how students receive phenomena, respond to phenomena, value, organise, and internalise value (Krathwohl et al., 1973) would all fall under the affective domain.

**Figure 1**

*Outline of the sequence of events in problem-based learning (Adapted from Wood, 2003)*



As Eagly and Chaiken (2005) point out, attitude is a psychological tendency that is expressed by evaluating a particular entity with some degree of favour or disfavour. A favourable response is a positive attitude. Meanwhile, a disfavourable response is a negative attitude. There are different definitions for attitude, but most tend to focus on the notion that it includes measuring objects, human beings, and others on a spectrum between positive and negative. This conceptualization derives its intuitive appeal from its compatibility with humans' pervasive tendency to explain others' behaviour in terms of their dispositions (Schwarz, 2007). Student attitude, is linked to success and motivation (Arman, 2018). It is also shaped through learning experiences; if the experience is agreeable a positive attitude results and vice versa (Rahman, 2019). Furthermore, student attitudes about learning determine their ability and willingness to learn. In order to enhance student's motivation, willingness and ability to learn a course, positive stimulus is needed. In this study, researchers used the PBL method as a stimulus to enhance students' attitude towards learning.

Many studies have examined the relationship between PBL and student's learning attitudes (Arman, 2018; Cheong, 2008; Chung & Chow, 1999; Kadir et al., 2013; Lo, 2004). On the whole, these have found that students prefer the PBL learning method because it involves individual and team learning, self-regulation, working through real life problems, working in a group, meaningful and well organised lessons, effective use of material, knowledge transformation, and re-learning. According to Kadir et al. (2013) students who engaged in PBL groups exhibit a more positive perception towards a course due to the high standard of instruction, chosen teaching techniques, and the activities involved. In addition, Chung and Chow (1999) revealed (from respondents' point of view) that participants' knowledge of a subject's content increased after the use of the PBL approach. Lo (2004) has also found that students developed a positive attitude towards PBL as it enables them to improve their ability to work in groups, enhance their study skills like sharing, transmitting knowledge, respect,



teamwork, and strategies to solve problems. Consequently, the success of the PBL approach depends on the positive attitudes of both the learner and the teacher (Treesirichod et al., 2018).

In contrast, there are challenges in implementing and practising the PBL method in teaching and learning; problems can be too well structured (in other words, students take too much time to get answers to problems, lack certainty about the final solution and any information gathered), teachers can be too directive, and tutorial groups can be dysfunctional (Dolmans et al., 2005). In a similar vein, Cheong (2008) discovered that individual students can find comprehending ideas difficult, in spite of discussing them with their group. These challenges could be minimised if PBL method were focused more towards mature and self-directed learners as in this study, in which the participants were selected from tertiary college level. Notwithstanding these challenges - and many others - PBL is one of the preferred methods for students' learning especially during the COVID-19 pandemic (Mathewson, 2020). Bird (2020) also states that the COVID-19 pandemic has led to unexpected events that have caused significant and broader changes in today's world, including in the educational sector. He further added that changing scenarios need new attitudes and behaviours that could shape the life of students, the ability to learn through problem-solving being in prime place. Overall, students' positive attitude is enhanced via PBL in comparison with traditional learning methods (Selccedil, 2010). De Jong et al. (2014) have pointed out that PBL positively contributes to students and teachers' satisfaction (and attitude). Similarly, in experimental research done by Alcázar and Fitzgerald (2005) revealed that learners under the PBL method show more positive attitude to the PBL strategy in comparison with the attitude of the control group participants taught according to the traditional lecture method. Therefore, this study is both timely and urgent.

### Hypotheses

In examining the PBL effect on students' learning attitude at the tertiary level in Bangladesh, the following hypotheses are tested:

Ho: There is no significant difference in learning attitude among tertiary level students following the implementation of Problem-based Learning.

Ha: There is a significant difference in learning attitude among tertiary level students following the implementation of Problem-based Learning.

### Method

In this study, the quantitative data collection and analysis were done through a true experimental research design - post-test only control group design. A true experiment incorporates the strongest and most rigorous experimental designs because it equates the groups through random assignment (Creswell, 2019).

**Table 1**

*Post-test only control group design*

Group	Treatment	Post-test
Experimental	R X	0
Control	R -	0

Table 1 tells that-

- R means randomly assigned participants groups

- X means the manipulation of Independent Variable
- O means both groups are subject to measurement of the Dependent Variable

This study incorporated only a post-test because, as Creswell (2019) argues, it decreases the threats of testing, instrumentation, and regression due to not using a pre-test.

The study was conducted in the Shariatpur district of Bangladesh. There are three government colleges in the district: 'X' Government College was chosen as the research site because, as a district level college, it is situated between divisional and remote areas of the country which makes it typical of the higher education system as a whole. It offers various courses. The study was carried out in the department of political science (the workplace of a member of the research team). The department offers both honours and master programmes.

The size of the study's population was 145 students from first year undergraduate political science class for the year 2019-2020. From this cohort, 60 students were randomly selected. Thirty participants were assigned to the experimental group and another thirty to the control group (again, as Creswell (2019) recommends). A simple random sampling method was used to select the participants through the application of a random number table. The advantage of a random sampling method is every unit of the population has the same probability of being chosen for the sample and there is no chance of partiality. The odd numbers of the random number table were selected for the control group and even numbers for the experimental group. All the 60 respondents gave their consent to be involved in this study and written permission was gained from the college principal. The confidentiality and anonymity of the respondents were guaranteed.

The conventional lecture method was applied for the control group, while the experimental group was taught using the PBL method. For both groups, the same topics from a course (Code-211903) of political science such as democracy, dictatorship, presidential, and parliamentary form of government were presented and discussed. Lesson plans reflected the method being used by groups' instructor. Wood's (2003) structure (Figure 1) was adapted as a major part of the lesson plan for the experimental group. On the other hand, a conventional lesson plan (introducing learning outcomes, lecturing, feedback and concluding remarks) was applied for the control group. Before implementing the PBL method, the idea was introduced to the experimental group members. The goals and expectations of PBL were given and explained. Their active engagement in group work was emphasised. At this point, some students were confused by the PBL concept - possibly because they sensed that, in practice, it would be slightly different from other group activities in which they had hitherto participated. Clarifications were given and students were excited to start the session. The PBL classes were conducted over a time span of 4 weeks through 45 minute sessions taken twice a week (Table 2). The same amount of time was spent for conventional lectures in the control group.

During Class 1, Students were assigned to work in a group of six. First, a brief discussion of the selected topic was led by the instructor. Later each group was presented with a scenario related to the topic. With a brief discussion, scenario (problem), and along with the text book, the students were left to their own devices and permitted to enquire about what they did not know and to find suitable resources to solve the problem given. From time to time, the instructor provided appropriate scaffolding and gave full authority to the students to find the possible solution. Students agreed on the extra information needed to solve the given problem and tasks were allocated among the group members to find the information. Some students needed extra time and they were encouraged to discuss after class using available communication platforms, as well as to do some online search.

**Table 2**

*PBL sessions in experimental group*

Week	Topic	Scenario (Problem)	Class 1 (45 minutes)	Class 2 (45 minutes)
1	Democratic forms of government	1	Group discussion	Presentation and Instructor's feedback
2	Dictatorship as a form of government	2	Group discussion	Presentation and Instructor's feedback
3	Presidential forms of government	3	Group discussion	Presentation and Instructor's feedback
4	Parliamentary forms of government	4	Group discussion	Presentation and Instructor's feedback

In Class 2, the Group reconvened and shared the new information and knowledge, and presented the findings/ solution to the class. The presentation allowed students to learn from their own and other groups. Before the end of the session, the instructor provided feedback, final scaffolding, and concluding remarks. The instructions were designed in a way that students were able to think critically, relate new knowledge to existing knowledge, use materials/ resources effectively, communicate, and engage well with group members, gain self-responsibility, and create a meaningful learning environment.

To evaluate the student attitude towards the method used in class, a learning attitude questionnaire (as a post-test) was adapted from Charif (2010) and Marmah (2014), and distributed to the students in both the control and experimental groups after the final session. The learning attitude questionnaire covered fourteen statements with a four point Likert-scale ranging from strongly agree (4) to strongly disagree (1). This agreement reflects students' attitude towards learning. For the content validity of the questionnaire, opinions of two experts from the relevant fields were taken. This experts' judgement used multiple judges rating, in which, the researchers discussed with the experts to rate each item in the instrument in terms of its matching or relevance to the content (as suggested by Rubio et al., 2003). Table 3 below shows the fourteen items that fulfilled the PBL criteria of Boud and Felati (1997), and PBL outline of Wood (2003). Item 9, superficial learning is included as a negative or opposite statement to avoid bias among the students. In achieving the reliability of the instrument used, the value of Cronbach Alpha was attained with a value of 0.89.

**Table 3***Learning attitude statement*

No.	Learning attitude statement
1.	Wider scope of learning
2.	Meaningful lesson
3.	Well-organized lesson
4.	Engaging lesson.
5.	Applying new knowledge for problem solving
6.	Encouraging interaction with other students.
7.	Greater scope of group work
8.	Effective use of materials
9.	Superficial learning
10.	Transmitting large amount of information

11. Higher scope of responsibility during learning.
12. Enhancing students' participation
13. Better scope for test preparation
14. Intention of re-learning through the method

SPSS 25 Version was used to analyse the data collected. For descriptive statistics, Mean and Standard Deviation were used. Meanwhile for inferential statistics, Independent Samples *t*-test was used and the level of significance was set at 0.05. *t*-test was applied to examine the significance level of the learning attitude between the experiment (PBL) and control (traditional lecture) groups. Table 4 provides the detail of the research question of this study, the instrument used, and the data analysis approach.

**Table 4**

*Summary of research questions, instrument and analysis*

Research Question (RQ)	Instruments	Analysis Technique
To what extent does Problem-based Learning effect the learning attitude of tertiary level students?	Learning Attitude Questionnaire	Descriptive Statistics: <ul style="list-style-type: none"> <li>• Mean</li> <li>• Standard Deviation</li> </ul> Inferential Statistics <ul style="list-style-type: none"> <li>• Independent Samples t-test</li> </ul>

## Findings

In this section, findings are presented and discussed, key themes and ideas being brought out in answer to the research question. Table 5 summarises what was discovered about the students' attitude to learning at X College.

**Table 5**

*Mean and Standard Deviation of the students' learning attitude in X College*

Item	Learning attitude Statement	Experimental Group (n =30)		Control group (n=30)	
		Mean	SD	Mean	SD
1.	Wider scope of learning	2.90	.66	2.73	.58
2.	Meaningful lesson	3.63	.55	2.70	.75
3.	Well-organized lesson	3.50	.77	2.30	.65
4.	Engaging lesson.	3.93	.25	3.00	1.083
5.	Applying new knowledge for problem solving	3.53	.62	2.83	1.14
6.	Encouraging interaction with other students.	3.33	.80	1.90	1.1557
7.	Greater scope of group work	3.77	.56	2.00	1.05

8.	Effective use of materials	3.03	.85	2.73	.94
9.	Superficial learning	1.70	.95	2.33	.75
10.	Transmitting large amount of information	3.60	.49	2.83	1.02
11.	Higher scope of responsibility during learning.	3.67	.47	2.53	1.074
12.	Enhancing students' participation	3.77	.43	2.90	.84
13.	Better scope for test preparation	3.73	.45	2.70	1.055
14.	Intention of re-learning through the method	3.93	.25	2.77	.89
Average score		3.43	.57	2.58	.92

Table 5 displays the means and standard deviations of the 14 items relating to learning attitudes in both the treatment and control groups. The mean scores of all the items for the treatment group are higher than for the control group except in the case of item 9 – superficial learning. The higher mean score indicates that students in PBL classes have a higher or more positive learning attitude compared to the students who were taught using the traditional lecture method. Most of the items are related to the state of learning and the scope and standard of instruction. Students also showed a more positive learning attitude in PBL classes as they were able to utilise their ability and skill to solve problems, to work in a group or team, to transform knowledge for others, and to prepare for their test or examination. As for item 9 – superficial learning, it helps to prove that students viewed the PBL method as more realistic and related to real life issues as compared to the lecture method that tends towards more superficial learning. The majority of the items are relevant and significant in measuring students' learning attitude since the mean score for each item is more than the average mean score of 3.43 (for the experimental group)

**Table 6**

*Group Statistics and Independent Samples Test results for student learning attitude between the experimental and the control group post-test scores.*

Group Statistics										
Summation of the participants' response for learning attitude		Categories of the students	N	Mean		Standard Deviation		Standard Error Mean		
		Experimental group	30	48.47		3.137		.573		
		Control group	30	37.00		8.166		1.491		
Independent Sample Tests										
		Levene's Test for Equity of Variances		t-test for Equality of Means					95% confidence Interval of the Difference	
				F	Sig.	t	df.	Sig. (2 tailed)	Mean difference	Std. Error difference
Summation of the participants' response for learning attitude	Experimental group	22.764	.000	7.179	58	.000	11.467	1.597	8.269	14.664
	Control group			7.179	37.9	.000	11.467	1.597	8.231	14.702

From the Group Statistics, the results show that the mean score (positive learning attitude) in the experimental group was 48.47 with a standard deviation of 3.137. There were 30 participants in the experimental group. In the control group, the mean score (positive learning attitude) was 37.00 with a standard deviation of 8.166. There were also 30 participants in the control group. Therefore, there was a mean difference of 11.47 between the experimental group and control group in the two group samples, with the mean score being 11.47 (two decimal points) higher in the experimental group.

With a 95 percent Confidence Interval of the Difference, based on the samples of 30 participants in the experimental group and 30 participants in the control group, it appears that students who are involved with the PBL method may have a higher positive learning attitude compared to students who were taught by conventional lecture methods. The results from the independent-samples t-test analysis suggests that the mean score could plausibly be somewhere between 8.269 and 14.664 lower amongst control group compared to the experimental group.

As the level of probability is set at the alpha level ( $\alpha$ ) of .05 ( $p < .05$ ), based on the above independent-samples t-test,  $p = .000$ . Since the value of  $p$  is  $< .05$ , there is a statistically significant mean difference in the experimental group compared to the control group. In other words, the results suggest that there is a mean difference in the population based on the sample that was studied. Based on this result, the null hypothesis of no mean difference in the population is rejected and the alternative hypothesis that there is a mean difference is accepted.

For Levene's Test for Equality of Variances, the null hypothesis is that both experimental and control groups have equal population variances. From Table 6, the null hypothesis is rejected since the variances for both groups are not equal,  $F(22.764)$ ,  $p = .000$ . The significance of this result in terms of variances is that the experimental population had a much more uniform positive response in that sample population (all closer to the mean value). On the other hand, the control group had wider variance suggesting that there were students that coped well with lectures/tutorials but this was not close to uniform in that group. The PBL treatment was equally effective for a larger proportion of the experimental sample population, inducing a positive attitude to learning.

## **Discussion**

The research question in this study sought to identify to what extent the PBL affected the students' learning attitude at a tertiary level (X College). A majority of the students from the PBL class had high agreement (positive learning attitude) for all the items in the attitude questionnaire except for item 9 (superficial learning). The mean score for the majority of the items was higher than the average mean score for the experimental group, namely meaningful lessons, well-organized lessons, engaging lessons, applying new knowledge for problem solving, transmitting large amount of information, higher scope of responsibility during learning, enhancing students' participation, better scope for test preparation and intention of re-learning through the method. Similarly, Mossuto (2008), identified greater interest among students who were involved in PBL classes. In this study, the students indicated that the PBL method enhanced their critical thinking, class engagement, their questioning techniques, and ability to work in a group. The method provided the students with an opportunity to improve their learning skills and how they perceived knowledge. Lo (2004), and Hossain and Sultana (2019) found similar findings in their PBL classes. Their findings revealed greater improvement in students' learning attitude as they were able to develop their study skills like sharing, re-learning, and working together as a group to solve real life problems. By contrast, Cheong (2008) claimed the participants claimed that it was hard to understand some ideas on their own in spite of discussing it with their group. There could be many reasons for this

condition. One of the necessary conditions is the role of the teacher as a facilitator. In this study, for the lesson to be more meaningful, well organised, and engaging, the facilitator guided the students with proper scaffolding from the beginning until the end of the lesson. He was thus able to reduce the students' difficulties in understanding some ideas related to solving the problem given to them. Likewise, Kadir et al. (2013) mentioned that students from a PBL group had a more positive perception of the course/lesson due to a high standard of instruction realised through novel teaching techniques. Having a good teacher as a facilitator in a PBL class contributes to enhancing students' positive learning attitude.

Overall, this study's results are consistent with those of Chraif (2010), and Alcazar and Fitzgerald (2005) who stated that a PBL-based experimental group showed a more positive learning attitude to the PBL method in comparison with the learning attitude of the control group (traditional lecture). The independent sample t test results of their research support the results of this study in terms of accepting the alternative hypothesis that shows there is a significant mean difference between the experimental and control groups. Furthermore, the correct implementation of a lesson plan and activities involved in the PBL class of this study are in line with the constructivist approach that promotes integration of new knowledge with existing knowledge, and allows for knowledge and authority sharing between teachers and students, with the teacher acting as a facilitator, and learning being in small heterogeneous groups (Arends, 1998; Elliott et al., 2000; Tam, 2000).

## Conclusion

This study was initiated to explore the effect of problem based learning on learners' attitudes among tertiary level students. The decision to concentrate on a sample from Bangladesh was motivated largely by that country's poor record to date in pedagogical innovation, meaning that the experiment could take place in the closest thing to an uncontaminated laboratory as this type of research permits. That students' attitudes towards learning were positively influenced by PBL to a statistically significant degree can be taken as a decisive endorsement of the method as a vehicle for teaching and learning. Clearly, the students who made up the sample have an appetite for constructivist approaches that place them at the centre and redefine the teacher as a facilitator, rather than an orator. As a contribution to the debate about future educational directions in Bangladesh, this is highly persuasive.

For the traditional lecture method, the news is not nearly so good. The control group's results are an obvious indictment of it, especially insofar as it fails to improve students' attitudes towards learning. While the connection is correlational, rather than provably causal, the high rates of absenteeism that are observable in traditional classes would appear to be a consequence of the failure of teachers to adopt more up-to-date teaching methodologies and strategies. As this study has indicated, students are more likely to take part in a class that gives them opportunities to take leading roles in learning, work in groups alongside their peers and construct new knowledge based on a synthesis of viewpoints and academic research. Of course, if this situation is to be guaranteed, teachers need to be comfortable with constructivism and the student/teacher relationships that it entails. For teachers, this means surrendering some of the authority that has historically underpinned their identity to reposition themselves as guides, philosophers and friends. It can be recommended, therefore, that embedding such approaches in Bangladesh's teacher training programmes is key. The study is not without limitations, as might be expected. Firstly, the connection between PBL and employability remains to be proven and further research along that line should be undertaken with all haste. More seriously, the participants' lack of familiarity with PBL may have impacted upon their ability to give truthful and complete answers to some of the questions. As much as the sampling strategy took this into account, research projects to come will no doubt help to finesse the findings presented here.

Irrespective of these limitations, it is hoped that this study has opened an avenue for all stakeholders involved in tertiary education in Bangladesh to work for the introduction of PBL as one of the main methods in teaching and learning, always keeping in mind the need to prepare students for future employment. This study could be used by researchers in Bangladesh from other fields, such as pure sciences and technical sciences. For researchers generally, this study could be expanded by comparing with other countries' tertiary education systems.



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